Application No. 10/636,105
Filed: August 7, 2003
TC Art Unit: 3729
Confirmation No.: 9143

AMENDMENT TO THE CLAIMS

1. (Currently amended) A method for mating an integrated circuit device having a plurality of conductive contacts with contact tips arranged in a predetermined pattern and extending from one surface of said device to a substrate having a plurality of conductive pads arranged on one surface of said substrate in said predetermined pattern, said method comprising the steps of:

applying a passivation layer to said surface of said device having said contacts extending therefrom;

applying over said passivation layer a layer of a first filled underfill to said surface of said device having said contacts extending therefrom;

partially curing said first filled underfill;

applying a layer of a second low-viscosity, lightly-filled underfill to at least said conductive pads of said substrate surface, wherein the second low-viscosity lightly-filled underfill is filled between 0-30% by weight and comprises a curing agent wherein the curing agent is at least one of anhydride, phenolic resin, amine, or a mixture thereof;

aligning said device with said substrate such that said contacts are adjacent corresponding pads; and

subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads.

2. (Cancelled)

3. (Original) The method of claim 1 wherein said first underfill applying step comprises the step applying at least one layer of

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said first underfill to said surface of said device having said contacts extending therefrom; and partially curing each of said at least one layer.

4. (Original) The method of claim 3 further including the step of applying at least one layer of said first underfill to said surface of said device having said contacts extending therefrom and partially curing each of said at least one layer, wherein at least one of said at least one layer of said first underfill is selected to reduce the coefficient of thermal expansion of the first underfill.

5. (Currently amended) The method of claim 1 further including the step of removing said first underfill from said tips of said conductive contacts subsequent to said step of applying ~~step~~ said layer of first underfill to said surface of said device having said contacts extending therefrom.

6. (Original) The method of claim 5 wherein said removing step comprises the step of polishing at least the tips of said contacts.

7. (Original) The method of claim 5 wherein said removing step comprises the step of etching said layer of first underfill to expose said tips of said contacts.

8. (Original) The method of claim 5 wherein said removing step comprises the step of chemically mechanically polishing said layer of said first underfill to expose said tips of said contacts.

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9. (Original) The method of claim 5 wherein said removing step comprises the step of reactively ion etching said layer of said first underfill to expose said tips of said contacts.

10. (Original) The method of claim 5 wherein said removing step comprises the step of laser milling said layer of first underfill to expose said tips of said contacts.

11. (Original) The method of claim 5 wherein said removing step comprises the step of laser ablating said layer of first underfill to expose said tips of said contacts.

12. (Original) The method of claim 1 wherein said step of applying said first underfill comprises the step of applying said layer of first underfill by at least one technique selected from the group of spinning, brushing, dispensing, spraying and screen printing.

13. (Original) The method of claim 1 wherein said step of partially curing said layer of first underfill comprises the step of partially curing said layer of first underfill utilizing a technique selected from the group of B-staging, soft baking, application of compressed gas, hot gas drying, oven heating, UV light curing and IR baking.

14. (Original) The method of claim 1 wherein said step of applying said layer of said second underfill to at least said pads

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on said substrate surface comprises the step of coating at least said pads with a fluxing agent.

15. (Cancelled)

16. (Cancelled)

17. (Original) The method of claim 1 wherein said step of applying said layer of said second underfill to at least said pads on said substrate surface comprises the step of coating at least said pads on said substrate surface with a polymer flux.

18. (Cancelled)

19. (Currently amended) The method of claim ~~18~~ 1 wherein said step of applying said layer of said second underfill to at least said pads on said substrate surface comprises the step of coating at least said pads on said substrate surface with an underfill with a filler load ranging ~~from~~ between 0 to 10% by weight.

20. (Original) The method of claim 1 further including the step of curing said first underfill and said second underfill.

21. (Original) The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of applying forced hot gas to reflow said conductive contacts.

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22. (Original) The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of applying forced hot air to said device and said substrate to reflow said conductive contacts.

23. (Original) The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts within an infra red oven.

24. (Original) The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts in a hot bar reflow process.

25. (Original) The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts in a hot plate reflow process.

26. (Original) The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts in a vapor phase reflow process.

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27. (Original) The method of claim 1 wherein said step of subjecting said device and said substrate to a reflow process to conductively couple said conductive contacts to said conductive pads comprises the step of reflowing said conductive contacts in a fume gas reflow process.

28. (Cancelled)

29. (Cancelled)

30. (Cancelled)

31. (New) The method of claim 1, wherein the curing agent is anhydride selected from the group consisting of hexahydrophthalic anhydride, methyl hexahydrophthalic anhydride, methyl-5-norborene-2,3-dicarboxylic anhydride, tetrahydrophthalic anhydride, methyl tetrahydrophthalic anhydride, nadic methyl anhydride, and mixtures thereof.

32. (New) The method of claim 1, wherein the curing agent is phenolic resin selected from the group consisting of bisphenol A, bisphenol F and mixtures thereof.

33. (New) The method of claim 1, wherein the curing agent is amine selected from the group consisting of diethylene triamine, triethylene tetramine, and mixtures thereof.

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34. (New) The method of claim 19, wherein said layer of said second underfill is filled between 0-10% by weight with one of silica, quartz, alumina, boron nitride, carbon, aluminum-nitride, and a mixture thereof.

35. (New) The method of claim 1 wherein at least one of said first filled underfill and said low-viscosity, lightly-filled underfill contains a curing agent selected from the group consisting of anhydride, phenolic resin and amine.

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